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Clinical and Haematological Parameters of Dorcas gazelles (*Gazella dorcas*, Linnaeus, 1758).

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Abstract— A number of 52 Dorcas gazelles (*Gazella dorcas,* Linnaeus, 1758) were used to establish basic data on some clinical and haematological profiles. Gazelles studied were raised in Khartoum State (Sudan).

Clinical and haematological profiles determined were; heart and respiratory rates, rumenal motility, body temperature, values of haemoglobin concentration (Hb), packed- cell volume (PCV), erythrocyte sedimentation rate (ESR), red blood cell counts (RBCs), white blood cell counts (WBCs), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and differential count.

Body temperature was not affected by age variations. Females showed higher values of body temperature. Body temperature was higher during autumn where the ambient temperature and relative humidity were high. Females showed higher levels of WBCs count. In winter, values of Hb, PCV, ESR, WBCs, MCV, MCH and polymorphnuclear neutrophils% were increased. During winter, gazelles could live on green alfalfa with no or little tendency to drink water. RBCs count increased in autumn.

In a small group of recently fawned gazelles, the clinical parameters of their neonates were determined to identify the associated adaptability mechanisms during the first three months of age. Mean pulse rate and body temperature increased during the next two months of age.

Keywords: *Wildlife - Dorcas gazelle - Gazella dorcas – Haematology – Clinical parameters.*

I. INTRODUCTION

Several articles have been published on free-ranging and captive Dorcas gazelles (*Gazella- dorcas*, Linnaeus, 1758), however, there are some available publications on the clinical and haematological profiles of captive Dorcas gazelle **(Bush *et al*, 1981 and Faragalla *et al*. 2005)**, Captive Mountain gazelles (*Gazella g. gazella*) **(Reitkerk *et al*, 1994)** and captive Grant gazelles *(Gazella granti)* **(Seal and Schobert, 1976)**.

Dorcas gazelles appear to inhabit desert and semi-arid regions in the Sudan, where some water, fresh or saline, or dew and succulent food are available. Many authors discussed the physiological basis for the capacity of gazelles to survive in extreme desert areas, under the restricted water intake and fluctuated temperature. The available publications about captive Dorcas gazelles, in the Sudan, are restricted to studies on the physiological adaptation; particularly water economy, food and water requirements, intake of sea water, the daily cycle of activity and the effects of water deprivation **(Thomspon and Ghobrial, 1965; Carlisle and Gabriel, 1968; Ghobrial, 1970; 1974 and 1976; Ghobrial and Thompson, 1976; and Mohammed, *et al* 1988)**.

Thompson and Ghobrial (1965) investigated the water economy of Dorcas gazelles. The authors observed that, with increasing water deprivation and dehydration, body temperature tended to lose homeostasis and there was some degree of hyperthermia. The urine became concentrated, faecal pellets smaller and drier and food intake was reduced. **Thompson (1968)** noted that, homoeothermic mammals regulated their body temperature by sweating, panting, shivering, sunning themselves, and by seeking shade. **Taylor (1970a)** investigated the effects of dehydration on the rectal temperature and evaporative cooling of air up to temperature 50 ºC in Grant's gazelle, Thomson's gazelle (*Gazella thomsonii*), Oryx (*Oryx beisa*), Wildebeest (*Connochaetes taurinus*), Zebu steer (*Bos indicus*) and African buffaloes (*Syncerus caffer*). The author noted that; rectal temperature of Grant's gazelle and Oryx still exceeded air temperature by between 0.5 and 2 ºC at 45 ºC, while the rectal temperature of 46.5 ºC for as long as 6 hours had no observable ill effects. Such high rectal temperatures would be lethal in most mammals. The author concluded that; at an air temperature of 45 ºC a dehydrated desert antelope with a body temperature of 46.5 ºC would gain no heat from the environment and would still be able to dissipate part of the heat generated by its metabolism through non-evaporative means (conduction). **Taylor (1970b)** explained the survival of east African Elands (*Taurotragus oryx*) in hot desert without drinking. They had a low body temperature in the morning and warmed slowly during the day and consequently they did not increase evaporation for heat dissipation. While Grant's gazelle warmed quickly to a very high body temperature, which exceeded air temperature of 40 ºC and neither panted nor sweated. **Ghobrial (1967)** studied the mechanisms for water balance and the effects of dehydration as a result of water deprivation in captive Dorcas gazelles. The author observed high values of PCV and Hb. concentration during summer and low values during winter. **Mohammed, *et al* (1988)** studied the effect of dehydration and subsequent rehydration in some parameters for Dorcas gazelles. The authors concluded that, dehydration, reduced food intake and decreased body weight, water content in faeces and Hb. These changes were reversed by rehydration.

Bush, *et al* (1981) recorded variations associated with differences in age for Hb, MCV, lymphocytes and eosinophils counts. They also noted that, males had significantly higher values for PCV, Hb and RBCs. While, abnormal health status resulted in significantly lower PCV, Hb and RBCs values. In abnormal health groups WBCs, MCH and neutrophils proportions increased while lymphocytes, monocytes, and eosinophils and basophiles proportions decreased. **Reitkerk, *et al* (1994)** found that, the values of RBCs, PCV, Hb and lymphocyte % decreased with age from high levels in juveniles to low in adults. The

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values of WBCs and neutrophils % increased from low levels in juveniles to higher levels in adults, while the values of MCV, MCH and fibrinogen of low values in the neonatal age and reached the maximum in adults. The authors recorded high values of PCV, Hb, MCV, MCH, and fibrinogen in males while the MCHC values were almost identical in the two sexes. According to **Reitkerk, *et al* (1994)**, the effect of winter and summer seasons on the values of RBCs, MCV, MCH, and MCHC for both sexes and for all age groups showed low values of MCV and MCH in summer than in winter and RBCs and MCHC values were higher. The effects of the slow, quick and net capture techniques on the hematological values was recorded and the animals undergoing slow capture had significantly lower MCHC, higher WBCs, higher neutrophils % and nitrous numbers and low in lymphocyte %. The haematological profiles of males and females varied, although in females' differences in lymphocytes values of animals exposed to slow capture were even more pronounced than in males. Evaluations were also made with a small number of anaestheized animals for the values of RBCs, PCV, MCHC and fibrinogen. The values of RBCs, PCV and fibrinogen of anaestheized animals were lower than the values for those caught by the net. Recently, the normal mean values for haemoglobin, packed cell volume, red blood cell count, white blood cell count, erythrocyte sedimentation rate, total protein, albumin, uric acid, glucose, creatinine, sodium, potassium, inorganic phosphate, magnesium, zinc, copper and iron were obtained from blood or plasma of six males and 4 females *Gazelle dorcas* and reported by **Faragalla, *et al* (2005)**. The authors found that, males had significantly higher values for white blood cell count, total protein and potassium, and had significantly lower values for red blood cell count and glucose than the females, but the rest of the parameters were not found significantly different between the two sexes.

Awareness should be directed to the common problems, which have to be overcome when working with captive gazelles. Ignorance about their normal parameters and the deviation from normalities should be taken into consideration.

II. Materials and Methods

Fifty-two Dorcas gazelles (*Gazella dorcas*, Linnaeus, 1758) from three different herds were selected for study **(Table 1)**. They were divided into five age groups; neonates (≤1 month old, n = 5), infants (1-3 month old, n = 11), juveniles (3-6 month old, n = 5), sub adults (6-12 month old, n = 11) and adults (>12 month old, n = 20) according to **Rietkerk, *et al* (1994)**.

Each herd belonged to a different owner and the herds were kept in Khartoum State. A programme of hand rearing was set up over one year period.

Each animal was ear-tagged for identification and its body weight was determined using (10 -16000) scale balance. (Seca, Germany).

Table (1): A description of the structure of three gazelle herds examined for clinical parameters

Herd No.	Location	No. of gazelles					Total
		Neonates (≤1 month)	Infants (1-3 months)	Juveniles (3-6 months)	Sub adults (6-12 months)	Adults (>12 months)	
1	Faculty of Veterinary Science, University of Khartoum (exp. herd)	3	7	3	3	5	21
2	Ozozab wildlife farm	2	0	0	2	13	17
3	Jabal Awliah wildlife farm	0	4	2	6	2	14
	Total	5	11	5	11	20	52

For feeding; during the first season, efforts were exercised to encourage neonates to accept bottle-feeding. Neonates that were brought from wilderness responded well and continued suckling goat milk using plastic bottles and soft rubber-teats. After deliveries, locally born neonates were fed on their mother's (colostrums) for about seven days. Orphan gazelles were fed on (half) diluted goat milk for the first 24 hours and on whole goat milk thereafter.

Initially six feedings per day were offered at four-hour intervals, which were reduced gradually. Adapting the neonate gazelles to suckle directly from a goat used for milking and kept for this purpose continued this programme. From the age of 17-21 days, neonates began to feed on leaves and were offered fresh alfalfa, but milk continued to be their main diet until they were 3 months old. The young gazelles continued to feed on alfalfa and sometimes sorghum grains until they were established in the adult quarters.

Adult gazelles were fed on a diet consisting of fresh alfalfa; alfalfa hay and sorghum grains. Mineral salt blocks and drinking water were available *ad .lib.*

1. Clinical Parameters

The respiratory, pulse, rumination rates and body temperatures were measured once every month, throughout the period from November 1996 to October 1997. Animals were captured manually and kept in stalls one day before the examination and sample collection. Haematology profiles were determined monthly **(Table 2)**.

Table (2): Source and samples collected from apparently healthy Dorcas gazelles

Herd	No. of gazelles	No. of blood samples
Experimental herd	13	104
Ozozab Wildlife Farm	14	57
Jabal Awliah Wildlife Farm	14	74
Total	41	235

2. Haematological Measurements

All blood samples were collected from the jugular vein using single-use vacutainer needles and 5 ml vacutainer tubes containing heparin (Becton-Dickenson, Rutherford, USA). Sometimes the blood was collected using disposable 5-10 ml syringes, especially in case of neonate and infant gazelles. The blood samples were examined on the same day of collection. All laboratory procedures were carried out according to **Schalm, *et al* (1975)**.

Three newly born gazelles were used to observe the normal physiological activities during the first 3 months of age. The respiratory rates, rumenal motilities, heart rates and body temperatures were measured and recorded in the same day of parturition. These measures were undertaken thereafter, weekly for the first month of age and fortnightly for the second and third month.

3. Statistical Analysis

Data obtained from the clinical parameters and haematology values were analyzed using STATISTICA statistical package (Version, l993). Analysis of variance (one way ANOVA) according to Gomez and Gomez, (1983) was used. Duncan Multiple Range

(DMR) test was used to separate between the mean differences. The Student's t-test was used to perform and tabulate the clinical and/or the haematological parameters with sex and pregnancy period's variations.

III. RESULTS

Clinical and haematological values for the Dorcas gazelles were described in **(Tables 3, 4 and 5)**. The data presented were for animals of normal health status, age groups, seasons and sex respectively.

The differences between the neonate, infant, juvenile, sub adult and adult groups, at (P<0.05) were calculated. Variations relating to age were found in some of the clinical and the haematological profiles of Dorcas gazelles.

There were insignificant differences between the age groups P<0.05 for the values of pulse rate, rumenal motility, body temperature and respiratory rate **(Table 3)**. The significant differences were noted for Hb, PCV and WBCs values. Haemoglobin levels increased with the age above three months noting the lowest level in infants and increased with age to the highest level in adults. Packed cell volume values were higher in neonates, lower in infants, and increased to the maximum level in adults. Leukocyte counts were high in adults, decreased to low levels in juveniles and reaching the lowest levels in sub adults. There were insignificant differences between the age groups (at P<0.05) for the values of ESR, RBCs, MCV, MCH, MCHC, neutrophils%, lymphocytes%, monocytes% and eosinophils%.

The differences between winter, summer and autumn seasons, at P<0.05 were calculated for clinical and haematological parameters **(Table 4)**. They were noted for the respiratory rate and the body temperature. Respiratory rates reached maximum levels in autumn, decreased in summer and the minimum levels were during the winter season. The values of the body temperature showed slight fluctuations and decreased to the lowest levels in summer and increased in winter and autumn seasons. It was found that there were insignificant differences between winter, summer and autumn seasons for the values of pulse rate and rumenal motility.

Significant differences were noted for the values of Hb, PCV, ESR, RBCs, WBCs, MCV, MCH, neutrophils%, lymphocytes % and monocyte%. The values of Hb, WBCs, MCV, MCH and neutrophils% showed a similar pattern, with maximum levels in winter, decreased in summer and the minimum levels were in autumn. Red blood cells and lymphocyte percentages, had inverse patterns, being at the maximum levels in autumn, decreased during the summer and the minimum levels were in winter. Values of ESR and PCV gave maximum levels in winter, minimum levels in summer and increased relatively in autumn. Monocytes % values being maximum in autumn, minimum in summer and increased in the winter. The values of MCHC and eosinophils% showed no significant differences in the three seasons at P<0.05.

At P<0.05, .there were significant differences between male and female groups for all parameters described in **Table (5)**, the overall means for pulse rate and body temperature were higher in female groups, with an opposite trend for respiratory rate and rumenal motility at P<0.05. Females had higher values for RBCs, WBCs, PCV, MCV, MCHC, neutrophils% and monocytes%. Males were significantly higher in the levels of Hb, ESR, MCH, eosinophils% and lymphocytes % than females.

IV. DISCUSSION

Age variation has a significant effect on the values of Hb, PCV, and WBCs. In the present study Hb concentration and PCV, increased with age above three months. The lowest level was in infants and increased with age to the highest level in adults. In three months-aged gazelles, feeding on maternal milk were eventually reduced, and the infant began to wean on the adult ration. Progressive increase in Hb and PCV values with the increase of age might be attributed to the increase in the demand of tissues for growth and development. **Bolte, *et al* (1970)** observed a marked reduction in Hb and PCV levels in newborn White-tailed deer (*Odocoileus virginianus*) in Oklahoma (USA) due to food insufficiency. An inverse pattern for Hb and PCV values was noted for Mountain gazelles, being high in juveniles and low in adults **(Reitkerk *et al.*, 1994)**. Leukocyte counts, in this study were found high in adults, decreased to low levels in juveniles and reached the lowest levels in sub adults. Leukocyte counts were very sensitive to various biological and physiological factors such as age **(Conley, 1980)**. More data are needed to explain the effect of age on leukocyte counts pertaining to other physiological factors.

Marked seasonal changes in ambient temperature and relative humidity in the Sudan affected gazelles due to the high heat load during summer and autumn and low thermal load in winter. There were no effects of seasonal variation on the values of pulse rate and rumenal motility. The heart rate of Dorcas gazelles was not affected by the state of dehydration **(Mubarak, 1986)** and by the state of immobilization **(Greth, *et al* 1993)**. In the present study, heart rate showed progressive increase when animals were excited due to hand capturing.

The type of grazed fodder commonly affects rumenal motility. In this study gazelles were always fed on the same diet during the period of the study, therefore, rumenal motility was not affected by seasonal variations.

Body temperature and respiratory rates showed gradual elevation of their values to reach maximum levels in autumn season. This may be attributed to the relative elevation in environmental temperature together with the increase in environmental humidity during autumn. This result was in line with the findings of **Ghobrial (1967)** in captive Dorcas gazelles in Sudan. The author reported higher levels of the rectal temperature measured in summer rather than winter. A drop in Eland's rectal temperature was associated with a slower respiratory rate **(Taylor, 1969)**. In the present study, our results agree with the findings of **Taylor (1970b)** in six species of East African ungulates, including gazelles. The author reported physiological adaptation of gazelles through sweating and panting to reduce the body temperature during the hot weather. **Thompson (1968)** and **Ghobrial (1967)** were also reported these findings in captive and free-ranging Dorcas gazelles.

The female had higher pulse rates and body temperature in this study. Perhaps they were more easily stressed by fright and this might explain these differences due to sex. Males showed higher values for respiratory rate and rumenal motility. It was noticed that males usually showed laboured respiration and panting during handling, this might be due to genetical properties in males.

Values of MCHC and eosinophils % were not affected with seasonal variations. This may be attributed to the adaptive mechanism to improve blood capacity for carrying oxygen in desert mammals. **Ibrahim (1997)** noted similar findings in domestic Nubian goat. The author reported that seasonal differences observed in the percentages of eosinophils did not reach the level of significance. Our results disagree with the findings of **Rietkerk *et al.* (1994)** in the values of MCHC in Mountain gazelles, who noted elevation of the values for this parameter in summer than in winter and attributed the cause to heat stress. Decline in values for Hb, WBCs, MCV, MCH, and neutrophils % from higher levels in winter to lower levels in autumn may be due to many factors. Of these factors, captive Dorcas gazelles showed little tendency to drink water during cool seasons, but drank in summer, when the ambient temperature regularly rises **(Habibi, 1990)**. In winter season, when the ambient temperature is suppressed, there was an increase in feed intake **(Bligh, 1972; Payne, 1990)**, and indigestibility **(Bhattacharya and Hussien, 1974)**. It was noted that gazelles, in winter season could live only on green alfalfa with no or little tendency to drink water. This agrees with the observation of **Habibi (1990)** in Mountain and Rheem gazelles

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(*Gazella subguttrosa*) and that of **Ghobrial (1970)** in captive Dorcas gazelles. This behaviour resulted in haemocentration of the blood and the elevation in the values of Hb, MCV and MCH during winter. **Reitkerk *et al.* (1994)** reported similar findings in Mountain gazelles. **Hassan *et al.* (1987)** reported that, decline in blood Hb as a result of increase of environmental temperature and relative humidity in autumn could be related to a reduction in cellular oxygen consumption, and consequent decline in tissue heat in sheep. In the winter season, values of WBCs and neutrophils % were higher than in summer and autumn. The lowest values during the summer may be attributed to haemodilution consequently to an increase in water consumption stimulated by the rise in environmental heat load. Lower levels of total leukocyte counts during the summer were previously reported in goats **(Vaidya, *et al* 1970)** and in camels **(Mehrotra and Gupta, 1989)**. The exposure to low temperature and low consumption of food were regarded as the physiological causes of neutrophilia **(Kelly, 1984)**. In the present study, the counts of RBCs were significantly higher in autumn due to increase in ambient temperature and relative humidity, and lowest in winter. The increase in RBCs counts for Dorcas gazelles show a positive correlation with rise in ambient temperature and relative humidity **(Ghobrial, 1967)**. Our findings were similar to the results of **Reitkerk *et al.* (1994)** in Mountain gazelles, and **Ibrahim (1997)** in Nubian goats for the elevation of the RBCs count during the summer rather than winter. Our findings agree with the result noted by **Al Sayed (1997)** in that lymphocytes % were significantly higher in autumn. The higher values of ESR and PCV in the winter season may be attributed to haemoconcentration due to very low water intake. Many workers took the haematocrit ratio as a measure of the rate of water loss and obtained significant results **(Ghobrial, 1967)**. Water restriction may result in an increase in PCV and plasma. **Abdalatif and Ahmed (1993)** noted similar results in Desert sheep. In this study, higher levels of monocytes % were observed in autumn and lowest in winter. This is in agreement with the findings of **Ibrahim (1997)** in Desert goats and **Al Sayed (1997)** in Desert sheep.

Mehrer (1976) noted differences in the blood parameters due to sex in the American bison (*Bison bison*). Results in this study agree with the author in that females had significantly higher values of RBCs, PVC, MCHC, neutrophils % and monocyte %, whereas in the male groups the values of MCH, lymphocytes %, and eosinophils % were significantly higher than in the female groups. **Diebbe and Clausen (1975)** reported that, the African elephant (*Loxodonta africana*) had approximately higher WBCs values in the female than in male groups. Similar results were found in Dorcas gazelles in this study. Hb values were higher in male Dorcas gazelles **(Bush *et al.*, 1981)** and male Mountain gazelles **(Rietkerk *et al.*, 1994)**. Our findings agree with these findings. Due to excitability stress and fright, female groups showed an increase in the WBCs counts. **Brown and Drosser (1966)** explained the marked changes in many of the haematological and serum chemistry values in domestic animals due to stress and fright. **Schalm, *et al* (1975)** attributed the alternations in the differential leukocyte counts to the effect of stress. Our findings agree with the results of **Faragalla *et al* (2005)**, who reported significant differences in sex between 6 male and 4 female groups of captive Dorcas gazelle for the values of WBCs and RBCs. The insignificancy noted by the authors for the values of PCV, Hb and ESR may be attributed to the small number of animals (N= 10) used in their study or due to the small number of observations in the analysis.

Clinical Parameters of the Newborn Gazelle during the First Three Months of Age:

It was found that values of ESR, RBCs, MCV, MCH, MCHC, neutrophils %, lymphocytes %, monocytes % and eosinophils % were not affected by age variation. Age related changes in haematology had been well described in livestock **(Jain, 1986)** and a few non-domestic ungulates such as Dorcas gazelles **(Bush *et al.*, 1981)** and Mountain gazelles *(Gazella- gazelle)* **(Reitkerk *et al.*, 1994)**. Age-specific variation in Dorcas gazelles followed the general pattern for these gazelles, except for the shift in some parameters due to the stress of capture and anaethesia noted by the authors. In this study, capturing of animals was done manually one day before animal sampling. Animals were kept inside the stalls to avoid the short stress before they were inspected and sampled. Precautions were made to keep animals calm on the inspection table before examination and sampling to reduce the risk of stress. Fright or stress can cause significant changes in many haematological parameters **(Diggs, 1966)**. Animals stressed for a short time showed an increase in circulatory erythrocytes, which might be due to splenic contraction **(Hawkey, *et al.* 1980; Jain, 1986)**. **Jain (1986)** had been noted stress neutrophilia in domestic animals and by **Rietkerk *et al.* (1994)** in Mountain gazelles. Compared to the manual capture used in this study, the effect of darting in haematology of Grant and Thompson's gazelles was reported by **Dreveno, *et a*l (1974)**. The authors reported that, there was a reduction in the values of RBCs, PCV, and Hb while there was an increase in MCHC values during anaethesia.

The respiratory rate for neonates showed a trend of increasing during the first month of age (means range 62-70 pulse/min.) compared to of the next two months, in which it showed a decline trend (means range 26-61 pulse/min.). This may be attributed to physiological adaptation mechanisms or due to the effect of handling during the hiding period of neonates **(Walther, 1968)**, during which they used to lied-down for the first 2-6 weeks of age and stayed far from other members of the herd **(Essaghaier, 1981; Furley, 1986)**. An increase in the mean and the average pulse rates in the next months of age might be due to the increase in neonatal activity, since neonates started to search for food other than milk at the age of 4 weeks **(Lindsay and Wood, 1992)** in Dorcas gazelles and at 3 weeks of age in the Arabian Oryx *(Oryx leucoryx)* **(Flamand, *et al* 1994)**. Rumination cycle showed no apparent activity during the first month of age, thereafter during the next 2 months it showed, almost constant values which ranged between 1-2 pulse/min. Dorcas gazelle's neonates live entirely on milk during the first month of life **(Lindsay and Wood, 1992)** so that, the activity of rumination was lacking during this age. The increase in the maximum levels for the mean body temperature, during the next 2 months after birth might be due to the increase in muscular activity and to the heat gain from the environment, since the animal became more active in the 2nd and 3rd month of age and could move freely inside the fence seeking for sun or often shade during the hottest part of the day **(Ghobrial and Thompson, 1976)**. The standard deviation range was higher during the 2nd and 3rd months of age due to the wide variation between individual's neonate body temperature and this might be attributed to the difference in physiological activities adopted by each individual shortly before measurement of temperature.

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Table (3): Clinical parameters and haematological profiles of Dorcas gazelles vary with age (1996-97)

No.	Parameter	No. of Obser	Neonates (≤ 1mo. old)			Infants (1-3 months)			Juveniles (3-6 months)			Level of significance
			Mean	St.D	Min-Max.	Mean	St.D	Min-Max.	Mean	St.D	Min-Max.	
1	Pulse rate /minute	235	105.7	24.7	81-129	108.8	26	75-153	96.8	22	71-161	**N.S**
2	Respiratory rate/ min.	235	38	11	22-47	42.6	27	16-93	51.4	27.3	11-108	**N.S**
3	Rumenal motility /min.	235	1	0.8	0-2	1.2	1	0-3	1.3	1	0-3	**N.S**
4	Body temperature ºC	235	40.5	0.2	40.3-40.8	40.1	0.6	39-41.1	40.2	0.7	39-42	**N.S**
5	Haemoglobin g/dl.	232	11.6^c	0.7	11-12.7	10.5^d	2.2	8-14.5	11.9^b	2.5	8.2-18.9	**S**
6	PCV%	232	43.7^b	3.5	41-49	39.2^c	9.1	22-49	40.1^c	6.9	26-50	**S**
7	ESR mm/hr	232	1	0.8	0-2	2.5	3.4	0-10	3.7	5.8	1-23	**N.S**
8	RBCs 10^4/ mm^3	232	828.5	166.6	560-1045	626.5	277.2	345-1148	535.2	231	227-1213	**N.S**
9	WBCs, 10^2/ mm^3	232	40^b	6.9	32.5-47.5	28.7^d	7.8	17-40.5	40.5^b	15.7	17-72	**S**
10	MCV μ^3	232	51.7	15.9	41.1-75.4	137.1	166.8	37-508	87.3	40	28.3-171.8	**N.S**
11	MCH Pico gram	232	13.6	2.7	12.2-17.7	18.5	6.4	10.2-30.1	25.7	11.5	11.6-54.8	**N.S**
12	MCHC%	232	27.1	2.2	24.4-29.7	27.5	5.8	19.7-36.5	30	5.3	24.5-47.7	**N.S**
13	Neutrophils %	232	32.7	12.2	26-51	48.2	12.1	33-67	43.1	13.5	15-64	**N.S**
14	Lymphocytes %	232	56.7	11.8	49-74	50.7	12.5	30-65	54.3	12.9	36-82	**N.S**
15	Monocytes %	232	0.5	0.5	0-1	0.5	1.1	0-3	0.6	1.2	0-5	**N.S**
16	Eosinophils %	232	0	0	0-0	0.4	0.5	0-1	0.4	1.1	0-5	**N.S**

According to DMR test the means with the same superscripts are not significantly different at P<0.05

Table (3): (Continued)

S. No.	Parameter	No. of Obser	Subadults (6-12 months)			Adults (>12 months)			Level of significance
			Mean	St.D	Min- Max.	Mean	St.D	Min- Max.	
1	Pulse rate /minute	235	96.9	20.1	63-164	96.6	25.6	45-183	**N.S**
2	Respiratory rate/ min.	235	50.8	25.9	10-127	56.6	35.1	14-182	**N.S**
3	Rumenal motility /min.	235	1.2	1	0-3	1	0.8	0-3	**N.S**
4	Body temperature ºC	235	40	0.7	38.5-41.6	40.2	0.8	38.4-42.5	**N.S**
5	Haemoglobin g/dl.	232	12.1^b	1.5	8.7-18.9	12.7^a	1.5	9.3-18.5	**S**
6	PCV%	232	43.1^b	6	23-63	47^a	7.3	27-66	**S**
7	ESR mm/hr	232	2.6	4.3	0-30	4.2	9.3	0-31	**N.S**
8	RBCs 10^4/ mm^3	232	592.7	289.7	110-1281	557.5	296.7	101-1656	**N.S**
9	WBCs, 10^2/ mm^3	232	36.4^c	18	13.5-111	48.1^a	20.5	12-118	**S**
10	MCV μ^3	232	113	88.2	23.1-572.7	125.6	101.8	27.3-514.9	**N.S**
11	MCH Pico gram	232	28.3	22	9.4-125.9	34.7	28	9.8-145.8	**N.S**
12	MCHC%	232	28.5	5	14.3-57.1	27.9	5	13.9-52.6	**N.S**
13	Neutrophils %	232	45.4	14.6	16-78	45.3	14.7	19-80	**N.S**
14	Lymphocytes %	232	52.4	15	22-80	53.8	15.6	19-81	**N.S**
15	Monocytes %	232	0.3	0.7	0-4	0.5	1	0-5	**N.S**
16	Eosinophils %	232	0.2	0.6	0-3	0.1	0.4	0-2	**N.S**

According to DMR test the means with the same superscripts are not significantly different at P<0.05

Table (4): Clinical parameters and haematological profiles of Dorcas gazelles vary with season (1996-97)

Seri No.	Parameter	No. of observ.	Winter (1996-1997) ^{a}		No. of obser v.	Summer (1997) ^{b}		No. of observ.	Autumn (1997) ^{c}		Level of significance
			Mean ± St.D	Min-Max		Mean ± St.D	Min-Max		Mean ± St.D	Min-Max	
1	Pulse rate /minute	76	101.3 ± 28.8	45-183	55	92.9 ±18.5	65-155	104	96.5 ±21.1	60-164	**N.S**
2	Respiratory rate/ minute	76	48.8^{b} ±39.4	10-182	55	49.7^{b} ±26	13-116	104	59.6^{a} ±25.8	17-127	**S**
3	Rumenal motility /minute	76	1.2 ±0.9	0-3	55	1 ±0.9	0-3	104	1 ±0.9	0-3	**N.S**
4	Body temperature ºC	76	40.4^{a} ±0.8	38.4-42.5	55	39.8^{c} ±0.8	38.7-42	104	40.1^{b} ±0.6	38.5-42	**S**
5	Haemoglobin g/dl.	76	13.3^{a} ±1.9	8-18.9	55	12.9^{b} ±1.6	6.8-15.6	104	11.9^{c} ±1.3	8.2-15.3	**S**
6	PCV%	76	47.6^{a} ±9	22-66	55	42.7^{c} ±5	29-53	104	43.6^{b} ±7	29-53	**S**
7	ESR mm/hr	76	5.7^{a} ±9.2	0-51	55	1.6^{c} ±0.7	1-4	104	3.3^{b} ±7.9	0-30	**S**
8	RBCs 10^4/ mm^3	76	390.3^{c} ±212.2	101-1025	55	512.4^{b} ±271.4	111-1242	104	726.6^{a} ±240.8	227-1294	**S**
9	WBCs, 10^2/ mm^3	76	51.6^{a} ±22.4	12.5-112	55	38.9^{b} ±14.1	12-68	104	38^{c} ±16.4	17-111	**S**
10	MCV μ^3	76	171.8^{a} ±119.6	27.3-572.7	55	117.4^{b} ±93.1	23.1-508.9	104	67.2^{c} ±27.7	35.5-195.1	**S**
11	MCH Pico gram	76	47.4^{a} ±30.6	13.5-145.8	55	32.9^{b} ±23.7	9.4-111.4	104	18.7^{c} ±8.2	9.4-56.3	**S**
12	MCHC%	76	29.4 ±7.7	19.9-57.1	55	28.6 ±2.8	22.1-36.5	104	27.7 ±3.3	13.9-39.1	**N.S**
13	Neutrophils %	76	53.2^{a} ±15.1	20-81	55	46.4b ±11.3	17-68	104	39.2**Error! Not a valid link.** ±13.1	15-75	**S**
14	Lymphocytes %	76	46^{c} ±15.3	19-80	55	52.4^{b} ±11.2	29-78	104	59.9^{a} ±13.4	25-85	**S**
15	Monocytes %	76	0.5^{b} ±1.1	0-5	55	0.1^{c} ±0.4	0-2	104	0.7^{a} ±1	0-5	**S**
16	Esosinophils %	76	0.1 ±0.4	0-2	55	0.1 ±0.4	0-2	104	0.3 ±0.8	0-5	**N.S**

*a = November - December 1996 and January - February 1997./ ** b = March - May 1997./ ***c = June - October 1997

According to DMR test the means with the same superscripts are not significantly different at $P<0.05$

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Table (5): Clinical parameters and haematological profiles of Dorcas gazelles vary with sex (1996-97)

Seri No.	Parameter	No. of observ	Male groups		No. of observ.	Female groups [b]		Level of significance
			Mean ± St.D	Min-Max		Mean ± St.D	Min-Max	
1	Pulse rate/ minute	74	$96.6^{b}\pm23.9$	60-168	161	$97.6^{a}\pm23.2$	45-183	**S**
2	Respiratory rate/min.	74	$55.1^{a}\pm32$	11-182	161	$53.3^{b}\pm30.9$	10-180	**S**
3	Rumenal motility/min.	74	$1.3^{a}\pm1$	0-3	161	$1.0^{b}\pm0.9$	0-3	**S**
4	Body temperature ºC	74	$40.1^{b}\pm0.8$	38.4-42	161	$40.2^{a}\pm0.7$	38.7-42.5	**S**
5	Haemoglobin conc.g/dl.	73	$13.2^{a}\pm1.8$	8-18.9	158	$12.4^{b}\pm1.7$	8.6-18.9	**S**
6	RBCs, 10^4/ mm^3	73	$540.3^{b}\pm288$	101-1242	158	$578.5^{a}\pm276.9$	110-1294	**S**
7	WBCs, 10^2/ mm^3	73	$40.3^{b}\pm19.4$	12-112	158	$43.9^{a}\pm19.6$	12.5-118	**S**
8	PCV %	73	$43.8^{b}\pm6.6$	22-57	158	$45.2^{a}\pm8.8$	23-66	**S**
9	MCV, μ^3	73	$106.9^{b}\pm82.6$	23.1-514.9	158	$113.2^{a}\pm97.9$	27.3-572.7	**S**
10	MCH, P.g	73	$31.9^{a}\pm26.2$	9.4-145.8	158	$30.6^{b}\pm23.8$	9.4-125.9	**S**
11	MCHC %	73	$28.4^{b}\pm4.5$	19.7-52.6	158	$28.4^{a}\pm5.3$	13.9-57.1	**S**
12	ESR mm/hr	73	$3.2^{a}\pm5.1$	0-31	158	$3.2^{b}\pm5.4$	0-30	**S**
13	Neutrophils %	73	$42.6^{b}\pm14.3$	15-77	158	46.6a±14.9	16-81	**S**
14	Lymphocytes %	73	$55.5^{a}\pm15.9$	3-85	158	52.7b±15	19-81	**S**
15	Monocytes %	73	$0.4^{b}\pm1$	0-5	158	0.5a±0.9	0-5	**S**
16	Eosinophils %	73	$0.2^{a}\pm0.7$	0-4	158	0.2b±0.5	0-5	**S**

According to DMR test the means with the same superscripts are not significantly different at P<0.0

Table (6): Clinical parameters of newborn Dorcas gazelle for the first three months of age

Age Days)	Respiratory rate/ minute.		Heart rate/ minute		Rumination/ minute		Body temperature ºC	
	Mean±St.D	Range	Mean±St.D	Range	Mean±St.D	Range	Mean±St.D	Range
0	62 ± 24	35-83	86 ± 11	75-98	0	0	39.9±0.5	39.3-40.3
7	57 ± 15	42-72	84 ±4	80-89	0	0	40.2 ±0.4	39.9-40.6
14	68 ± 18	48-85	89 ± 7	84-98	0	0	40.6 ±0.2	40.3-40.7
21	70 ± 14	59-87	90 ± 19	75-112	0	0	40.8 ±0.1	40.7-40.9
35	61 ± 30	40-96	107 ± 20	88-129	103 ±0.6	1-2	40.8 ±0.7	40.3-41.6
49	47 ± 30	26-69	97 ± 7	92-103	105 ± 0.7	1-2	40.7 ±1.3	39.8-41.6
63	35 ± 7	30-41	81 ± 0.7	81-82	105 ± 0.7	1-2	41 ±0.7	40.5-41.5
77	26 ± 3	24-28	114 ± 29	94-135	105 ± 0.7	1-2	40.6 ±0.9	39.9-41.2
91	39 ±14	29-49	94 ± 6	90-99	1	0	39.9±1.3	39-40.8

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